New Research on Teacher Leadership in Schools: Efficacy of a survey method for analyzing multiple dimensions of leadership

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Abstract

In the past decade, teacher leadership has emerged as a key strategy for improving the quality of education in U.S. schools. Major foundations, federal education programs, and professional organizations are providing significant support for teacher leadership as a key strategy for improving the quality of education in U.S. schools. Teachers in U.S. schools have a variety of roles and responsibilities in addition to their primary responsibility of teaching in classrooms. While teacher classroom effectiveness has been the focus of extensive research, the roles of teachers as leaders in their schools, districts, and professional associations have been the subject of less research and analysis. The research design for this study of teacher leadership takes a broad view of the roles of teachers in their school and their profession. The study design follows from research-based constructs of the relationship of teacher leadership to education quality in K-12 education.

Keywords: Teacher Leadership, K-12 Education, STEM

Research Objectives

This paper describes new research on use of a survey methodology to measure and report on teacher leadership and analyze six possible dimensions of leadership roles and activities. The research is conducted with teachers who participated in different kinds of professional development initiatives. Recent education polices in K-12 education (Heyburn, Lewis & Ritter, 2010; Center on Great Teachers and Leaders, 2017; USED, 2016) have emphasized he role of teacher leadership, particularly with the professional learning needed for implementation of new state standards for teaching and learning. Two decades of research have documented the role of teachers as leaders, and recent teacher leadership development programs reveal the need for improved models for research on the extent to which teachers take on leadership roles in schools (York-Barr, J. & Duke, K.,2004; Jackson and Marriott, 2014; Bryk, et al, 2010; Mangin, 2007; Loeb, et al, 2010; Heller & Firestone, 1995; Snell & Swanson, 2000; Johnson, 2014).

In the present study, research on teacher leadership proceeded with data collected from teachers who participated in two programs: a) the Kenan Fellows Program for Teacher Leadership

in North Carolina, and b) Science Materials Camps for Teachers, summer professional development organized and led by the ASM Materials Education Foundation.

In the past decade, teacher leadership has emerged as a key strategy for improving the quality of education in U.S. schools. Major foundations, federal education programs, and professional organizations are providing significant support for teacher leadership as a key strategy for improving the quality of education in U.S. schools. Teachers in U.S. schools have a variety of roles and responsibilities in addition to their primary responsibility of teaching in classrooms. While teacher classroom effectiveness has been the focus of extensive research, the roles of teachers as leaders in their schools, districts, and professional associations have been the subject of less research and analysis.

The research design for this study of teacher leadership takes a broad view of the roles of teachers in their school and their profession. The study design follows from research-based constructs of the relationship of teacher leadership to education quality in K-12 education. The primary research questions addressed in the study are:

1) What is the degree of change in teacher leadership roles and activities for teachers who participated in a STEM Leadership program vs. teachers who participated in a Science summer professional development program?

2) What is the efficacy of a survey method for analyzing teacher leadership roles and activities in the areas of curriculum and materials, instruction improvement, advancing professional learning, advocacy for students, organizational decision-making, and professional educator organizations?

Teacher leadership is analyzed with data drawn from surveys with public school teachers who participated in two different professional development initiatives. Findings from the study can inform efforts to advance teacher leadership in schools and to improve further studies on the effects of teacher leadership.

Theoretical Framework

Current K-12 education policy emphasizes the importance of teacher leadership in the improvement of instructional practices, the successful implementation of standards-based curriculum development, and the development and use of student assessments. Standards for teacher education, both initial certification and ongoing professional development, have shifted to address important leadership roles of all teachers, as well as the additional leadership provided by experienced teachers acting as coaches, mentors, subject specialists, and managers of professional learning communities (CCSSO, Model Core Teaching Standards, 2013; Learning

Forward, A Systemic Approach to Teacher Leadership, 2017). The Center on Great Teachers and Leaders, supported by the U.S. Department of Education, provides models, research, and technical assistance to states and districts (2017) on developing teachers as leaders. Recent advocacy for teacher leadership has been led by national professional organizations, and by foundations providing support for teacher leadership initiatives at the state and local level, including the Teach-to-Lead project (ASCD/ NBPTS, 2017); National Education Association Teacher Leadership Initiative (2014); Learning Forward (2017); and the Gates Foundation (B&M Gates Teacher Leadership Grants, 2017).

New research is needed to analyze the growth of teacher leadership roles in schools and the effects of new models for leader development, particularly as they are implemented in STEM education. Education research has reported on and analyzed teacher leadership previously. York-Barr & Duke (2004) analyzed the evolution of teacher leadership roles, effects of professionalization, and federal and state initiatives such as merit pay and development of career ladders. Neumerski (2012) provided an analysis of the changing professional roles of teachers as well as administrators. Koellner and colleagues recently defined teacher leadership as follows: "teacher leaders mentor other teachers, lead professional development, and organize learning opportunities explicitly targeted at instruction for new standards" (Koellner, Jacobs, & Borko, 2011). A report on teacher leader development programs stated these programs "focus on advancing the subject content knowledge and pedagogy of selected teachers, improving their skills in providing leadership for other teachers, and connecting education to community partners" (Ross, et al, 2011). This study provides a detailed statistical analysis of teacher leadership in schools by teachers of STEM subjects.

Teacher leadership initiatives were supported by several federal education programs. The U.S. Department of Education (USED) supported state- and district-based teacher leader initiatives in STEM and other subjects through the Teacher Incentive Fund (Heyburn, Lewis & Ritter, 2010), as well as through federal grants to states under the Title IIB Math-Science Partnership (Bobronnikov, et al., 2014). In 2015, the National Science Foundation (NSF) released a Teacher Leader Initiative (NSF 15-092) under which proposals were requested "for new ideas and approaches that can be piloted….with the goal of discovering successful models for long-term, more established programs to support teacher leaders."

An additional rationale for advancing teacher leadership research is the limited usefulness of current teacher evaluation systems for analyzing teacher roles and effectiveness. An analysis of the criteria for evaluating teacher professional practice found in three instruments used in state evaluation systems (Danielson, 2013; Marzano, 2015; Stronge, 2015) showed teacher leadership roles and activities in curriculum development, school decisions, or professional development,

have a small role in teacher ratings (Blank, et al., 2016). The validity of statewide teacher observation and rating systems has been questioned, focusing on unreliability of student growth statistics, lack of comparable student assessment data for many teachers, and the limited view of teaching and learning found in observation measures (Harris & Herrington, 2015; Braun, 2015; Johnson, 2015, Danielson, 2016). The research on teacher leadership for this paper takes a broad view of the roles of teachers in their school and profession based on six research-based constructs of the relationship of teacher leadership to education quality in K-12 education.

Teacher leadership is an important component of STEM teacher development initiatives which operate at the local, state, and national levels. Well-known examples of STEM leader programs in operation for multiple years are: Kenan Fellows Program for Teacher Leadership, Knowles Science Teaching Fellows, Math for America, and the Exploratorium. In 2015, the USED organized a STEM Teacher Leader Convening for the heads of STEM Teacher Leader programs from across the country (USED, 2015; SRI/PSA, 2014). USED's Office of Innovation and Improvement established a website resource "Building STEM Teacher Leadership" which includes program models, design strategies, network development, and program evaluation based on recent research and program analysis (USED, 2016).

Methodology

This study is conducted based on a strong interest in developing measures for determining the extent to which teachers are providing leadership in schools. The study is intended to demonstrate the use of survey items which can be applied broadly for research with schools, that is, to measure the extent of teacher leadership activities. An important intended application of the research will be to analyze the effects of teacher leadership development programs on subsequent leadership roles and activities in schools.

Research-based Constructs. A survey instrument was designed, tested, and validated as one key tool for carrying out research with the new research model. The instrument is the Teacher Professional Leadership (TPL) profile. Survey items were designed based on prior published research over two decades in education and social science journals that can be grouped under six constructs:

1) Teacher leadership in developing school curriculum and materials,
2) Teacher leadership and collaboration with colleagues to improve instruction and assessment,
3) Teacher leadership within professional development and advancing professional learning,
4) Teacher engagement in organizational decision-making,

5) Teacher leadership in transforming education and advocating for students,
6) Teacher leadership in professional organizations.

Develop school curriculum and materials. Research on K-12 standards-based learning has cited research on teacher involvement in curriculum development. New math and science standards depend on teachers creating new kinds of STEM learning experiences for students and the roles of experienced teachers in leading others as coaches, mentors, subject specialists, and facilitators (Student Achievement Partners, 2016; Achieve/NGSS Lead States, 2013; NGA/CCSSO, 2010; CCSSO, 2013; Learning Forward, 2011). Research since the 1990s has shown that standards-based education requires teachers to have deep knowledge of their subject and the pedagogy that is most effective for instruction in their subject (Ball, et al., 2009; Hill & Ball, 2004; Loucks-Horsley et al., 1998; Porter, 2007).

Collaborate for instructional improvement. Research has shown the effects of teacher leadership and collaboration to improve instruction and common best practices (Hiebert & Stigler, 2017; Darling-Hammond & Sykes, 1999; Newmann, Carmichael, & King, 2016). The Lesson Study Model exemplifies the collaborative approach to teachers working together as professionals to provide leadership in instructional improvement (Armstrong, 2011). Standards-driven educational reform differs from prior reforms in the importance placed on teachers and staff working together at the school level to translate standards' goals and assessment results into more effective instructional strategies, and leadership by teachers is a key factor (Stein, 2014; Calvert, 2016; Demonte, 2013; Loeb, et al, 2010; Taylor, et al, 2011). The Professional Learning Standards (Learning Forward, 2011) emphasize the critical role of teachers in leading change in curriculum and instruction by collaboration at the school level (Little, 2011; Crowther, et al, 2002).

Lead professional development and learning. Many states adopted more challenging state standards for teacher education and preparation consistent with new content standards (CCSSO, 2013). Approaches to professional development have changed to address these standards, with a shift in focus toward advocating for continuous, school-based teacher professional learning versus more traditional methods of staff development, such as college course credits (Harrison & Killion, 2007; Numerski, 2012; Taylor, et al, 2011).

Engage in organizational decision-making. School organization research focused on distributed leadership models and found that effective leadership flows through networks of roles, and not as a characteristic of specific individuals (Ogawa & Bossert (1995), Ogawa, et al (2003) and Spillane (2006). Research on school leadership models and school improvement shows that teacher participation in decision-making is a key factor in positive school outcomes (Jackson and Marriott, 2014, Bryk, et al, 2010; Mangin, 2007; Loeb, et al, 2010; Heller & Firestone, 1995; Snell &

Swanson, 2000). Johnson and colleagues (2014) found that a collaborative method of leadership involving teachers contributes to gains in student performance and school-wide change in high poverty schools.

Transformational leadership and advocacy. A relatively new area of research with schools analyzes "transformational leadership" in which the leadership of a school and the education process is reorganized and reconsidered in order to reflect the needs of students and the local community context (Reeves, 2008; Givens, 2008; ISLLC, 2015; WCEPS/CALL, 2017).

Leadership in professional educator organizations. Research studies conducted with the National Board for Professional Teaching Standards (NBPTS) have tested the Board's criteria for quality teaching in support of teachers as professionals and leaders (NBPTS, 2017). Four education professional organizations sponsor teacher leadership initiatives: National Education Association, Association for Supervision and Curriculum Development, NBPTS, and National Network of State Teachers of the Year (NEA, 2017; ASCD, 2017; NNSTOY, 2020). Participation in local, state, or national teacher professional associations are a key form of leadership.

Three prior studies were conducted to test and improve the TPL profile instrument (Blank, 2018a, 2018b, 2019). With data from teacher survey items used in the 2018 study of Kenan Fellows, a factor analysis of responses was conducted. The results of factor analysis showed that the survey items did correlate under six leadership constructs (Blank, 2018a). The scales used in reporting survey results correspond to the research constructs and factor analysis. The survey is not designed to produce individual teacher results or evaluate the degree of leadership provided by individual teachers, but rather the survey produces group-level averages to analyze leadership for teachers in a school, district, or program.

Two Groups of Teachers for Study. New data for this study were designed to be collected from two different groups of teachers. First, surveys were administered online to teachers who participated in the Kenan Fellows Program for Teacher Leadership, a voluntary, highly recognized program in North Carolina. The Program director agreed to collaborate on this study and assist in collecting data from teacher fellow participants. The Kenan Fellows Program has been supported and operated in North Carolina since 2000. From the Kenan Fellows statement of purpose, the program:

> "…recognizes the critical need to develop and empower high-quality teachers, who, in turn, make learning more authentic for students. The Program bridges the gap between K-12 education, industry, and research by immersing teacher leaders in highly technical and/or locally relevant STEM work experiences and supporting them as they design

methods for transferring their learning back to the classroom." (Kenan Fellows Program for Teacher Leadership. https://kenanfellows.org/).

The Kenan Fellows Program addresses the critical need for high-quality professional development for educators, and is the largest (science, technology, engineering and math) STEM-focused teacher leadership program in North Carolina. Each year, outstanding K–12 teachers from across the state of North Carolina are selected for this year-long program, with numbers currently varying from 20 to 50 per year based on program funding. Key components are a three-week summer internship with a mentor in a research or applied STEM setting, and 80 hours of professional development that builds leadership capacity and promotes curricular design, bridging STEM at work with STEM at school.

Science teachers who participated in a Materials Science camp sponsored by the ASM Materials Education Foundation comprised the second group of teachers for the study. These teachers completed the online Teacher Professional Leadership survey as part of the program evaluation research (ASM Materials Camps, 2020). The Materials Camps for Teachers offer five-day professional development workshops to middle and high school teachers. The Materials Camps have been offered each summer since 2002. The goals of Materials Camps program are to: a) provide teachers with content knowledge aligned with Next Generation Science Standards to help them excite students about study in STEM fields, b) create awareness of STEM principles in the engineered materials world, and c) provide hands-on, minds-on activities aligned with NGSS that teachers can incorporate into their teaching, and learn skills for leadership with curriculum and instruction.

Data Sources

Survey data from the two groups of teachers–Kenan Fellows and Materials Camp science teachers–were analyzed to determine the extent to which each group of teachers exhibited leadership characteristics consistent with the six leadership constructs. Survey results were compared between groups to analyze differences in leadership behavior and consider reasons behind substantial differences in degree of leadership reported. This research was planned as a descriptive study of teacher leadership intended to validate measures of teacher leadership across multiple dimensions, demonstrate how quantifiable data can be collected and reported, and outline the use of teacher leadership survey measures for further research that could measure cause and effect with further implementation of teacher leadership initiatives.

The Teacher Professional Leadership (TPL) profile online survey instrument was administered through an online survey via email to 408 North Carolina teachers who had participated in the Kenan Fellows STEM Leadership Development program between 2010 and

2018. The survey was completed by 116 alumni Kenan Fellow teachers. The Kenan Fellows respondent group can be described through several demographic characteristics (see Table 1). The respondent group were teachers of science, math, engineering, and related subjects, and they were primarily middle grades and high school teachers. A large majority (75 of 116) of the Kenan Fellows responding teachers reported they were still full-time teachers.

Science teachers who voluntarily enrolled in one of the ASM Science Materials summer camps for summer professional development were sent an online TPL survey in September 2018 asking for teachers to report on their experience, and over 400 participants completing the initial survey. In Spring, 2019, a second survey was sent to science teacher respondents as part of the professional development program evaluation, and 151 teachers completed both parts of the data collection. The data from these teachers comprise the comparison group data for this study of teacher leadership.

Table 1: Demographic Characteristics

	Kenan Fell. (n 116)	Sci.Tchrs. (n 151)
Teaching Experience	%	%
3 yrs or less	0	13
4 to 8	20	14
9 to 15	29	26
16 or more	50	44
Highest Degree	%	%
Doctoral	7	8
Masters	80	46
Bachelors	13	46
Female	%	%
Male	76	69
	24	31
Race/ethnicity	%	%
African American	9	10
Asian	1	7
Hispanic, white	5	7
Hispanic, non-white	2	1
Amer Ind./Alas.Nat./Pac Isl.	0	1
White	82	74

Kenan Fellows position	%
Full time teaching	75
Hybrid/ Teaching, Admin.	8
Dept head or Instr. Coach	11
Administrator, full time	10
Retired	2

Findings

Prior to reviewing the collected survey data on teacher leadership constructs, it is important to consider the characteristics of the teachers who comprise the two samples of teachers being studied. The Kenan Fellows group had slightly more teaching experience. A large majority (79%) of Kenan Fellows responding teachers had nine or more years of experience, while 70 percent of the Science teachers group had nine or more years' experience. The Science teachers group included 13 percent with three or fewer years' experience as compared to none of the Kenan Fellows teachers. The Kenan Fellows teachers had a higher proportion of teachers with advanced degrees (87% masters or doctorate) than the science teacher group (54%). The demographic characteristics of gender and race/ethnicity are very similar between the two teacher groups, with both comprised of majority female and majority white teachers.

Developing school curriculum and materials.

Teachers responding to the Teacher Professional Leadership profile reported on the extent to which they shared with colleagues the curriculum and curriculum materials which they had developed. Secondly, they reported on whether they shared with other teachers any instructional practice or strategy they were using in their classrooms. These two questions address whether teachers are providing leadership to improve curriculum and instruction with colleague teachers within the prior 12 months. The data analysis shown in Table 2 indicates that Kenan Fellows respondents (n=116) had a high degree of leadership with curriculum and materials, i.e., 96 percent of responding Fellows shared curriculum and materials, and 93 percent of Fellows shared instructional practice or strategy.

The survey comparison group, the teachers participating in the Materials Science summer professional development camps, also had a high rate of leadership with curriculum and instruction, but at substantially lower levels than the Kenan Fellows. Among the 151 science teachers, 81 percent reported sharing their curriculum and materials with colleagues, and 77 percent reported providing leadership with other teachers on instructional practice and strategy.

Table 2. Teacher leadership in curriculum and instruction in 12 months

	Kenan Fellows (n=116) % yes	Science Teachers (n=151) % yes
Curriculum / materials development	93	81
Instructional strategy or practice	96	77

stat.sig. p<.02

Collaboration with colleagues on instruction.

A second dimension of teacher leadership focuses on how teachers collaborate with others to advance methods of improving instruction. The six items reported include participation in learning communities, analyzing assessments, and online virtual communities of teachers. The TPL survey results for the two samples of teachers are reported in Table 3.

A large majority of Kenan Fellow teachers participated in professional learning with other teachers, with 92 percent reporting they participated in a professional learning community in their school and 86 percent reported participation in a virtual learning network. Among the Materials Science teachers who completed the TPL survey, a majority (64 percent) reported participation in a school-based professional learning community and 28 percent reported participation in a virtual network with other teachers.

Most Kenan Fellow teachers provided leadership through other means of collaborating with colleagues, including mentoring new teachers (80 percent), observing teachers and providing feedback (70%) and co-teaching a course (51%). Leadership was less frequently reported by the Materials Science teachers in the study. The science teachers reporting on this measure indicated 42 percent mentored new teachers, 30 percent observed others and provided feedback, and 29 percent co-taught with another teacher.

Table 3. Collaboration with other teachers to improve instruction past 12 months

	Kenan Fellows % yes	Science Teachers % yes
Professional learning community	92	64
Analysis / interpret data	90	56
Teacher network virtual	86	28
Co-teaching course or unit	51	29
Mentoring a new teacher	80	42
Observe & feedback	70	30
stat.sig.	p< .002	

Leading professional development and professional learning.

A large majority of Kenan Fellows led professional development with other teachers in their school or district (see Table 4). The survey asked teachers to report on their leadership in six areas of possible leadership of professional development during the previous 12 months. The results show that among the Kenan Fellows reporting, 75 percent led professional development for teacher content knowledge (e.g., a content standard or topic in science or mathematics), and 78 led a development with instructional methods (e.g., students working in small groups). By comparison, only 36 percent of the Materials Science teachers reported leading professional development for other teachers on science content knowledge, and only 31 percent reported leading development on instructional methods.

In the area of assessment design or development of student assessments, slightly more than half (52%) of Kenan Fellows had provided leadership with other teachers, while only 35 percent of the group of Science teachers had provided assessment design/development leadership. Curriculum development was led by a large majority of Kenan Fellows (70%) with teachers in their school or district, while only forty percent of the Science teachers group provided leadership on curriculum development with their schools.

Table 4. Led Professional Development in past 12 months

Topic of PD	Kenan Fellows % yes	Science Teachers % yes
Content knowledge	75	36
Instruction methods	78	31
Curriculum develop	70	40
Leadership skills	52	24
Assessment design/develop	52	35
Use of data	59	NA

stat.sig. p <.002

Further cross-tabular analysis might focus on Leadership of PD by years of teaching experience, the subject of current teaching assignment, or by highest degree earned.

Engaging in school decision-making and planning.

A fourth dimension of teacher leadership that has been studied is participation in decisions and planning for their school. The TPL profile included 10 types of leadership roles at the school or district level (Table 5). Kenan Fellows teachers reported on their leadership prior to the Kenan Fellows year and their roles after participating in Kenan Fellows. The data show that many of the teachers selected as Kenan Fellows had leadership experience which may have supported their selection, but after the Fellowship year, additional leadership roles were assumed by the teachers.

Over half the Kenan Fellows (58%) had served as department heads in their school, and after completing the Fellowship year a total of 65 percent of teachers had served as department heads. Over half the Fellows had previously served in other leadership roles including on a School Leader team (60%), Induction or Mentoring of new teachers (52%), and serving on School Curriculum and Instruction committee (59%). After their Kenan Fellow experience the rates of leadership increased to 74 percent serving on School Leader teams, 71 percent providing Induction or Mentoring for new teachers, and 73 percent serving on School curriculum and instruction committees.

Some Kenan Fellows changed positions after their Fellowship experience. Following the year-long Kenan Fellowship, over one fourth of teachers provided leadership as an instructional coach (28%), and 16 percent of the Fellows took a position as a school Administrator. The change

in school roles and positions indicates that the Kenan Fellowship provided development of skills and credentials that helped to advance the teachers in their careers.

The school-level leader roles of Kenan Fellows varied from serving on a curriculum committee to being department or grade level chair to coordinating an extra-curricular activity of students. This set of items include a wide range of teacher leadership roles and these roles of teachers include a broader range of activities than have been considered in prior research on teacher leadership and school organization. Almost all the Kenan Fellows had multiple leader roles based on the item response analysis.

Table 5. Leadership in school decisions and planning 12 months

	Kenan Fellows	
	Before % yes	After % yes
Dept head or chair	58	65
Instruction coach	9	28
Supervise intern/tch. candid.	41	53
Induction/mentor new tch.	52	71
School lead team	60	74
Recruit/ interview teacher	52	72
School instr/curric. comm.	59	73
Dist. instr/curric. comm.	37	59
Administrator	3	16
Extra-curric.supv.	72	69

stat. sig. $p<.16$

Transformational leadership and advocacy.

To research transformational leadership, the TPL profile included six items which asked about ways that teachers might be involved in programs to improve services to youth and to link the school to broader community-wide efforts to guide youth. The survey results in Table 6 summarize data for surveys of the Kenan Fellows and the Materials Camps science teachers.

On this measure of teacher leadership, responses from the two groups do not show a consistent pattern across the six questions, and the differences are not statistically significant. The former Kenan Fellows teachers reported slightly higher levels of leadership with four items: increasing diversity (30%), seeking funding resources (64%), outreach for student experiences (34%), and working on community problems (65%). The Science teachers group had more

involvement in leading with tutoring for students (33%). The response differences between teacher groups were not statistically significant across the items in this scale.

Table 6. Leadership in transforming education and advocacy for students

	Kenan Fellows % yes	Science Teachers % yes
Develop/improve tutoring/after-school	27	33
Increase diversity in school	30	18
Sought additional resources	64	52
Adult volunteer in community org.	30	30
Worked on community problems	65	53
Outreach for student experience	34	22
Collaborate with industry	46	NA

stat.sig. <.47

Leadership with professional educator organizations. Both groups of teachers were asked to report on ways they have been involved in a professional association or organization, such as a statewide science or math teacher association or a local teachers union. Data reported in Table 7 show that across the nine items surveyed, the Kenan Fellows reported high levels of professional organization activity, and the degree of professional leadership increased after the Fellowship year. For example, 96 percent of former Fellows reported making a presentation to other educators, which was an increase from 71 percent prior to the Fellowship year. By comparison, only 40 percent of science teachers reported making a presentation to other educators. The data also show that 20 percent of Fellow respondents held a professional organization leader position prior to the Fellow year, which increased to 28 percent after the Fellowship year. Only 13 percent of science teachers reported holding a professional organization leadership position. Differences in the responses of the Kenan Fellows and science teacher groups were statistically significant ($p<.02$) across the complete item scale.

Table 7. Leadership in teaching profession during career

	Kenan Fellows		Science
	before	after	Teachers
Type of leadership	% yes	% yes	% yes
Made presentation beyond school	71	94	40
Led professional development	66	93	37
Developed curriculum or materials	69	86	47
Conducted research or action research	37	50	26
Held leader position in professional org.	20	28	13
Developed assessment items	47	53	24
Organized meeting of professional org.	23	62	17
Writer, reviewer or editor	15	29	7
Collaborated with higher ed. for teacher certif.	42	75	23
stat.sig.	KF bef: aft p<.09 KF aft: SciT p<.02		

Discussion

The intent of pursuing research on teacher leadership had two broad purposes: first, to develop and validate measures of teacher leader roles, activities and behavior that would encompass the roles that teachers take on in our public schools, and second, to use research to make note of the wide range of types of leadership that teachers provide in public education. Too often, broader understanding of our elementary and secondary schools has a very limited picture of how schools operate and what functions teachers perform in our schools. The primary functional role of the teacher is to provide instruction in classrooms, – but in this research the goal was toto document and analyze several types of leadership that teachers carry out beyond the core role of instructional leader.

The design for this study provides a test for use of survey questions to analyze teacher leadership that is demonstrated by two groups of public school teachers – one set of teachers who participated in a STEM teacher leader fellows program, and a second group of teachers who participated in a science teaching professional development program that did not emphasize leadership development. The analysis of survey data showed that the two groups differed in the extent to which leadership was reported and the areas in which they served as leaders. For example, both groups of teachers had high levels of leadership activity in developing curriculum

and materials, as well as sharing materials with colleagues. Almost all the Kenan Fellows reported sharing curriculum and materials they had developed with other teachers in their school (93% positive), and almost all reported sharing instructional practices and strategies with other teachers (96%). The science teachers participating in summer professional development also reported high levels of leadership with curriculum and materials (81%) and sharing instructional practices (77%).

An area of leadership in which the two samples differed was the degree of collaboration with colleagues for improving instruction. About 90 percent of Kenan Fellow teachers collaborated with other teachers through professional learning community, analyzing and interpreting data, and participating in virtual online network. The science teacher group reported significantly lower levels of colleague collaboration for improving instruction. Only 30 percent of science teachers had co-taught a course with another teacher or observed another teacher and provided feedback. For the Kenan Fellows sample, the data showed that a majority served as mentors for new teachers, co-taught with others, and provided feedback to fellow teachers from observing instruction.

The Kenan Fellows program selected teachers to participate through an application and review process. Thus, it is not surprising that many of these teachers had experience in positions of leadership in their schools. The survey data show that 60 percent had served on a school leader team and 56 percent had been department chairs prior to entering the Fellowship year. However, the data also show that the Kenan Fellowship experience increased the degree of involvement of the teachers in school decision-making and planning after their Fellowship year. The percentage of former Fellows participating in mentoring of new teachers increased from 52 to 71 percent, and their participation in district level curriculum and instruction committees increased from 37 to 59 percent of responding teachers who were Kenan Fellows.

Another finding of the study was the effect of Kenan Fellows program participation on professional organization leadership. Across the scale items, which reported on teacher involvement with curriculum and assessment development, organization leadership, writing/editing for journals, collaborating with higher education, and organizing conferences, the Kenan Fellows teachers significantly increased their professional organization involvement and leadership. The data analysis also showed that involvement in Kenan Fellows resulted in high activity in leading professional development with other teachers. The Fellows teachers were almost twice as likely to be leaders of PD for other teachers, as compared to the science teacher comparison group.

The study demonstrated the use of a survey instrument for analyzing and reporting on teacher leadership (see Appendix for example items from the instrument). One advantage of this instrument was its capacity for analyzing leadership across multiple dimensions (six) of teacher

leadership that have been included in education research. This study also demonstrated that leadership roles and activities of teachers could be compared between different teacher samples, including one sample of teachers who participated in a leadership development program and a sample of teachers who participated in a content-focused professional development. The survey data collection was carried out through a non-intrusive online platform that provided data aggregation and analysis without identifying individual teachers or using the data for evaluation of teacher performance. The survey instrument shows strong potential for school, district, and program-level research on teacher leadership. For future research, the instrument and data collection should be adapted to collect further data from administrators which would offer useful comparison with teacher-reported levels of leadership. Next studies would also benefit from collection of data on leadership from a control group of teachers randomly selected from the same population as a treatment group of teachers participating in leadership programs, or a matched teacher control group.

The study also showed the effectiveness of the Kenan Fellows program model for developing leadership knowledge and skills of their participating teachers. While many of the teachers did carry out leader roles prior to their entry to the program, the data analysis shows that after participating in the Kenan Fellows Program, the level of leadership activity of these teachers increased substantially. It is likely that the schools and districts employing these teachers received a significant benefit in the teachers' increased capacity for providing leadership with others in curriculum development, instruction, school planning and decisions, as well as in leading professional education organizations.

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Appendix

Teacher Professional Leadership profile--Example Items

Q5. During the past year, have you collaborated with other teachers with regard to the following?

	No	Yes
Professional learning community[1]	○	○
Analysis and interpretation of data	○	○
Engagement in a virtual teacher network	○	○
Co-teaching a course, subject, or unit	○	○
Mentoring another teacher (formally or informally)	○	○
Observation of a peer and providing feedback	○	○
Led professional development session	○	○

Q6. Have you had one or more of the following roles in your school or district? Select all that apply

	Never	Yes Before KF	Yes After KF
Department chair or grade-level or team lead	○	○	○
Instructional coach	○	○	○
Supervisor for an intern or teacher candidate	○	○	○
Provided induction support or mentor for a new teacher	○	○	○
Served on a school leadership team	○	○	○
Participated in recruiting or hiring a teacher	○	○	○
School committee member on instruction, curriculum, or assessment	○	○	○
District committee member on instruction, curriculum, or assessment	○	○	○
Administrative Position	○	○	○
Leader or coordinator for student extra-curricular activity	○	○	○

Q7. Have you taken one or more of the following actions in your school, district, or community?

		Yes, within the past (select one):		
	No	12 Months	2 Years	3 Years or more
Developed or improved tutoring, mentoring, or after-school classes	○	○	○	○
Worked to increase or maintain student diversity in the school enrollment	○	○	○	○
Led efforts to seek additional resources to meet student needs	○	○	○	○
Served as adult volunteer in a community organization for youth	○	○	○	○
Worked with other educators or community members to address problems	○	○	○	○
Conducted outreach to local community for student work/career learning experience	○	○	○	○